DEFENCE COMMUNICATION SYSTEMS

Defence Division STK

COMPLETE DIGITAL SERVICEINTEGRATED AND SECURE – PCM TRANSIT NETWORKS – PCM MABX's★

The STK Strategic Communications System is based on the following fundamental design principles.
● Automatic Search and Routing ● Switching of voice, data, telex and facsimile ● High survivability ● Communications Security ● Service Integration ● Hierarchical Network control ● Interoperability ● Small sized ● Large number of military features.

PCM MABX

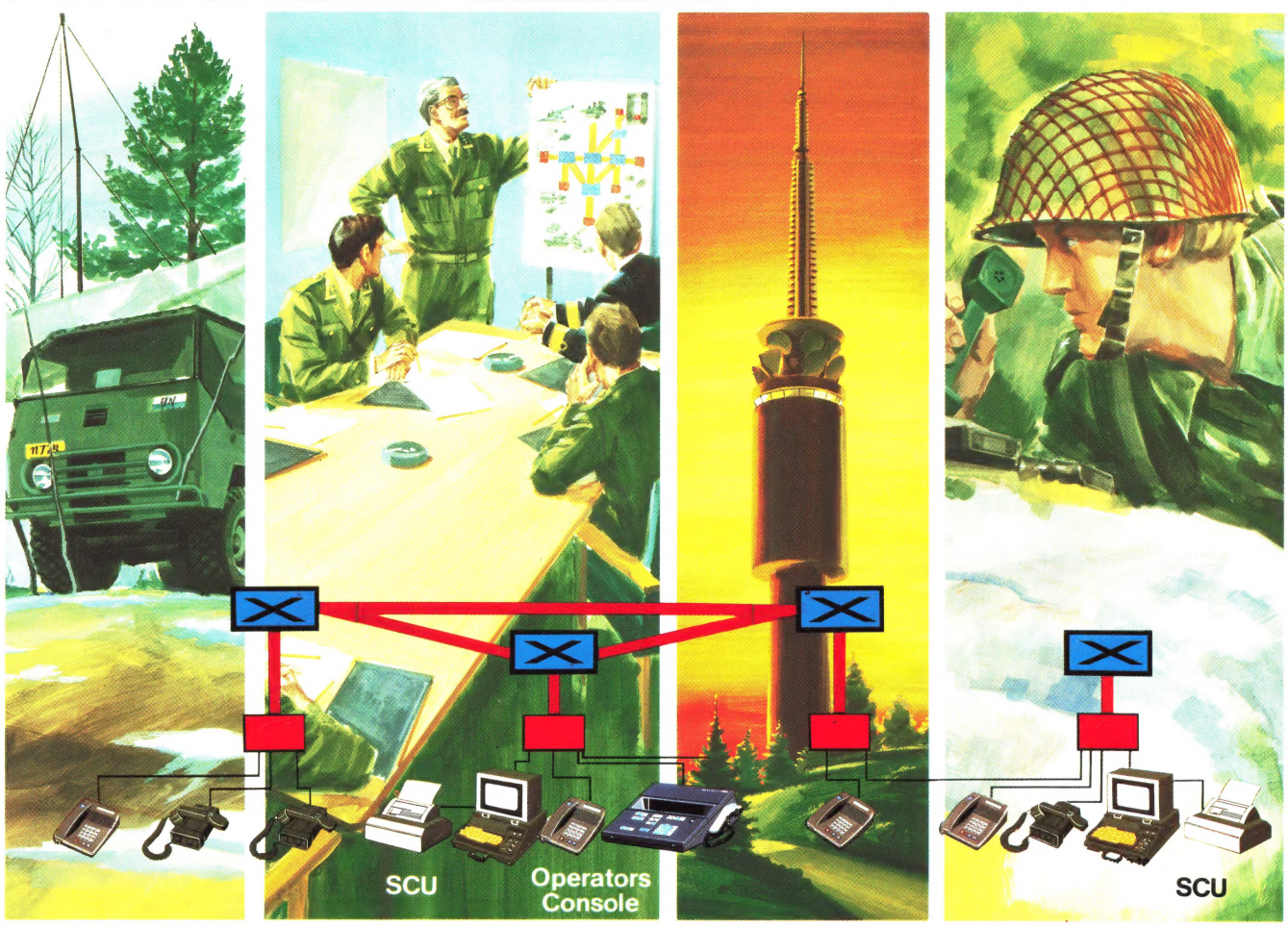
can be installed as a centralized or distributed exchange, stand alone exchange or military PABX networks. The system provides circuit switching, packet switching, message switching, communications security and operation and maintenance functions.

LARGE MILITARY TRANSIT NETWORKS

can be built, based om switching modules and subscriber multiplexers. The units can be configured as pure transit exchanges, subscriber access untis or a combination. The system offers integration of circuit switching, packet switching, message switching, communications security and network control.

★ Military Automatic Branch Exchange.

THE STK DEFENSE COMMUNICATIONS FAMILY consists of:



PCM MOBILE | PCM MABX | PCM TRANSIT NODE | DELTAMOBILE

THE SWITCH (SDS)

The Small Digital Switch (SDS) is a microprocessorcontrolled digital switch module. It can either be used alone or as an element in larger circuit switches. One SDS can connect eight 2 Mbit/s PCM systems, together providing 240 channels. The routing principle makes it possible to meet the following requirements:

- Free numbering
- Flexibility: a subscriber can keep his number when moving in the network
- The subscriber will always be located if a free path from A to B exists
- Automatic configuration of new routing tables

Between all SDS's common channel signalling in timeslot 16 is performed by using a Small Integrated Packet Switch, the Truck Processor (TP).

THE MULTIPLEXER (MUX)

is the general access point of the system. The MUX has three main functional elements:

- The subscriber interface
- The multiplexing unit
- Line termination

The MUX is connected to subscriber equipment such as telephone sets, data and facsimile terminals and other analog or digital networks.

The line interface is a normal PCM interface for a first order 30/32 channel system which conforms to CCITT rec. G.703.6 and G.732. Channel units can be connected to any of the 30 interface positions in the MUX.

Typical channel units are:

- 2 wire subscriber (dial pull/push button)
- 2 wire subscriber (LB-telephones)
- 4 (2) wire with E&M
- 2 wire for city lines
- 64 Kbit/s co(contra)directional
- Data, type X21, X25, X26/V10
- Data asynchronous DTE V24
- 80 Kbit/s for digital telephones/ data subscriber
- X25 towards PS
- 64 Kbit/s V11 interface towards separate PS and SCU.

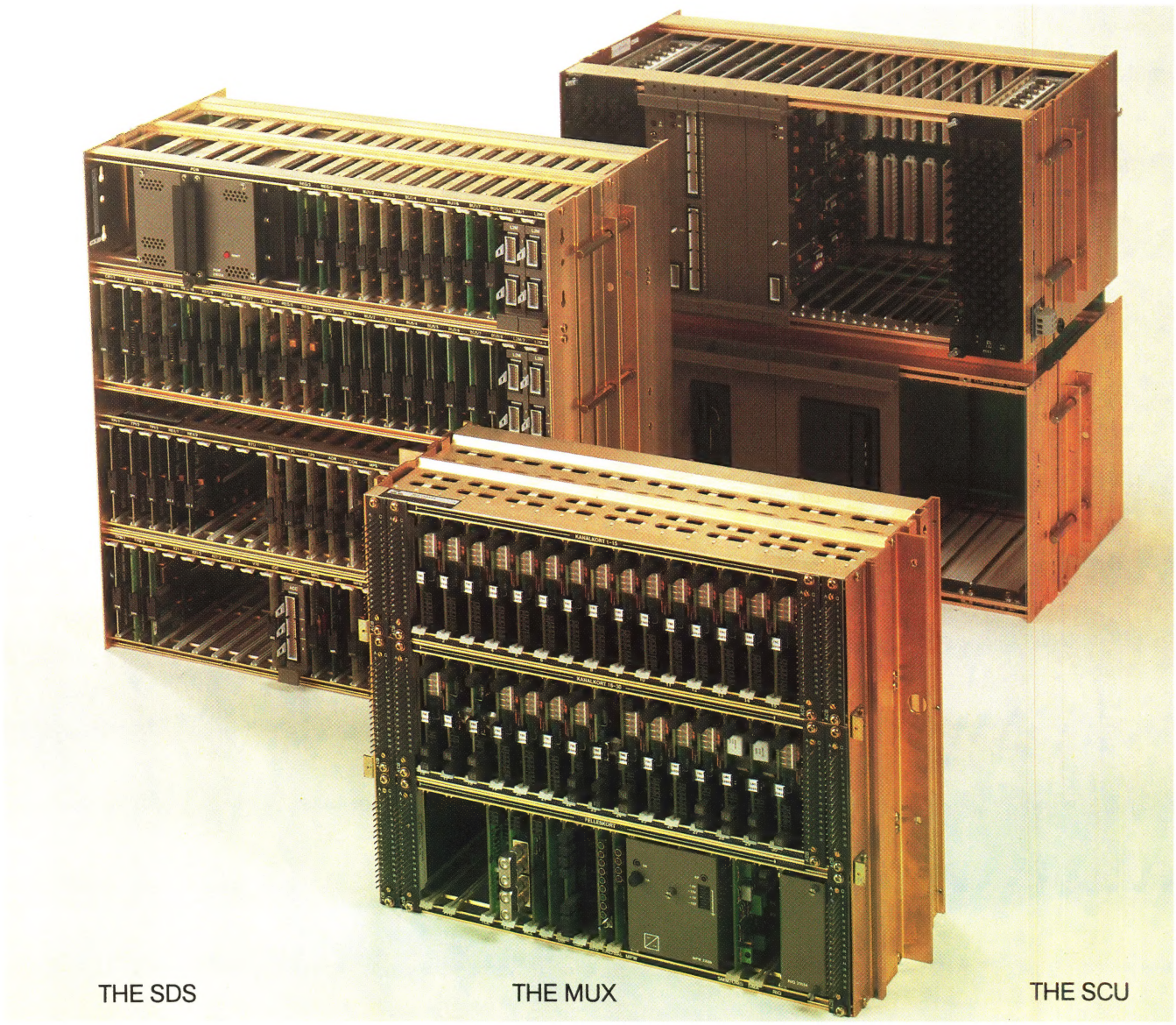
THE SYSTEM CONTROL UNIT (SCU)

The communications network is supervised from the SYSTEM CONTROL UNIT (SCU) which has the following main purposes:

- Control and test of the entire network
- Subscriber and service handling
- Collation of collected data
- Authentication system for defining user and access levels.

The SCU will communicate with switches in the network using a packet switched system conforming to CCITT X25 protocol.

The SCU is connected to a MUX as a data-subscriber. Several System Control Units are combined into a hierarchical control system to command limited sections of the network as well as the Regional Control Center (RCC) and the Network Control Center (NCC) for the entire network.



THE SDS THE MUX THE SCU

The peripherials:

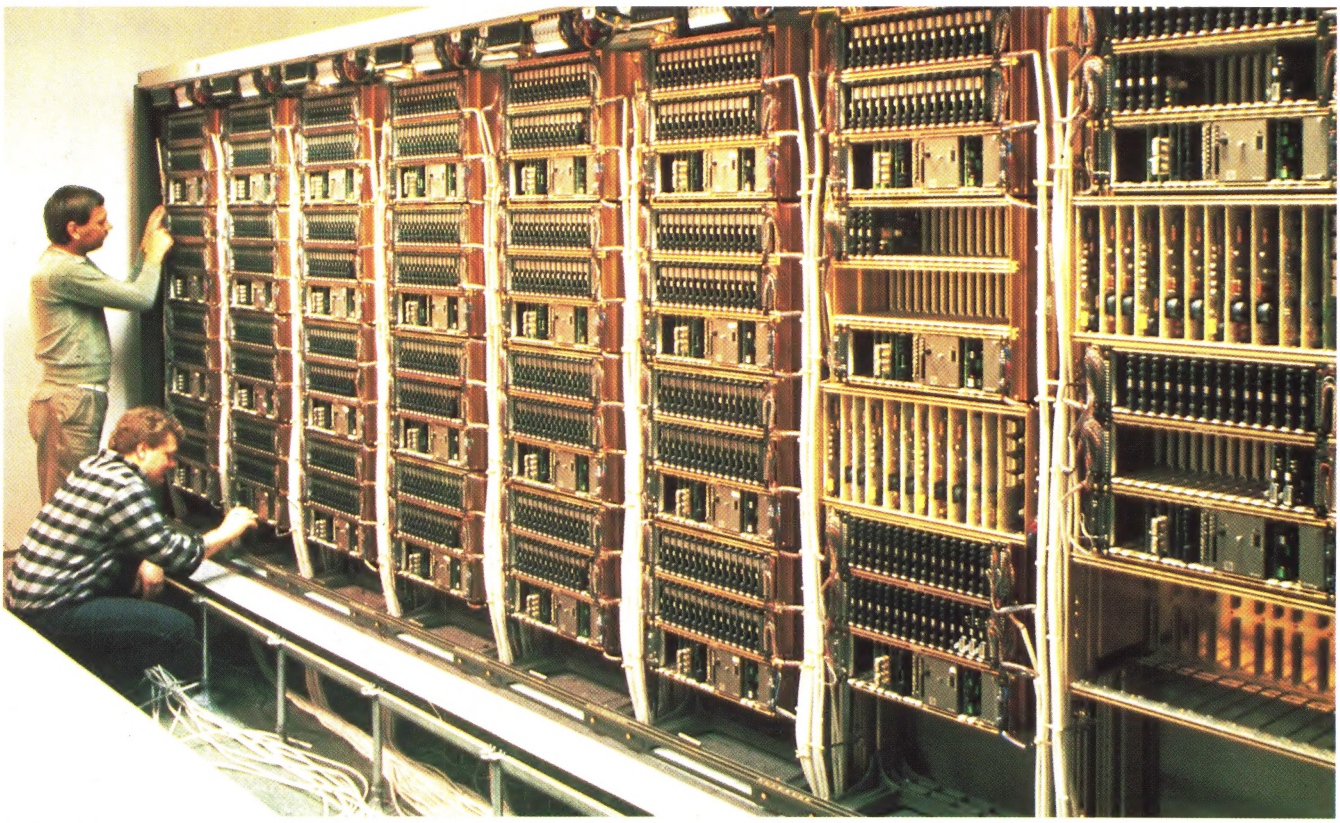
- Teleprinter
- AC
- Printer
- Digital Telephone
- SCU monitor & keyboard

SERVICES AND FACILITIES

In addition to normal telephone and data communication services, the system will provide following functions:

- Precedence
  The network has 4 priority levels
- Preemption
- Non secure warning
  If some part of an established connenction is routed through non-secure communication lines, subscribers are warned
- Closed user groups*
- Leased circuits*
- Hotline/sole user
- Call transfer, follow me, stock-broker
- Affiliation and re-affiliation
  Enables the subscriber to keep the same number when he moves around in the network
- Group number
- Redirection of calls activated by the subscribers themselves
- Busy line transfer
- Don't answer transfer
- Conference, dialled, permanent list conference and intrusion
- Add on from conversation/conference
- Call waiting/camp
- Ringback
- Fully distributed operator service

*Can only be set up from the SCU.



A fixed installation of the modules in cabinets.

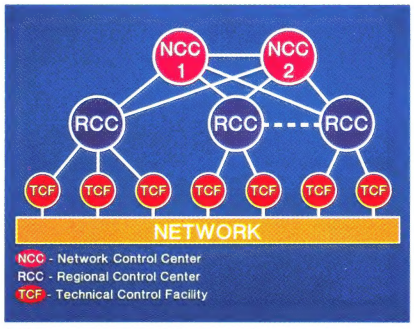
GENERAL

Todays military networks must provide more than just voice communication. To satisfy present and future needs in military transit and PABX networks, both voice and flexible data communication are required along with communication security. The STK DEFENCE COMMUNICATION SYSTEM satisfies these needs using a combination of packet switched and circuit switched transport functions. The system is based on the building block principle. The individual modules are autonomous and use standard CEPT/CCITT interfaces for connections and interworking with other modules.

The system consists of these main components:
PCM Multiplexer (MUX)
Circuit Switch Module (SDS)
System Control Unit (SCU)
Packet Switch (PS)*
Operators (Attendants) Console (OPC)
Store and forward Message Switching unit (MS)*
Bulk Encryption Device (BED)*
*Not shown in the figure.

NETWORK CONTROL

The network control system for the STK DEFENCE COMMUNICATION SYSTEM,is implemented in an hierarchical manner to meet redundancy survivability and autonomy requirements. One homogenous network control system covers all necessary facilities for operation and maintenance of the complete network including all network components. The system is bound together by means of a Packet Switched Communications System which is integrated with the network signalling system. The man/machine communication is identical for all network control units.



Hierarchical Network Control

FLEXIBILITY

Modularity

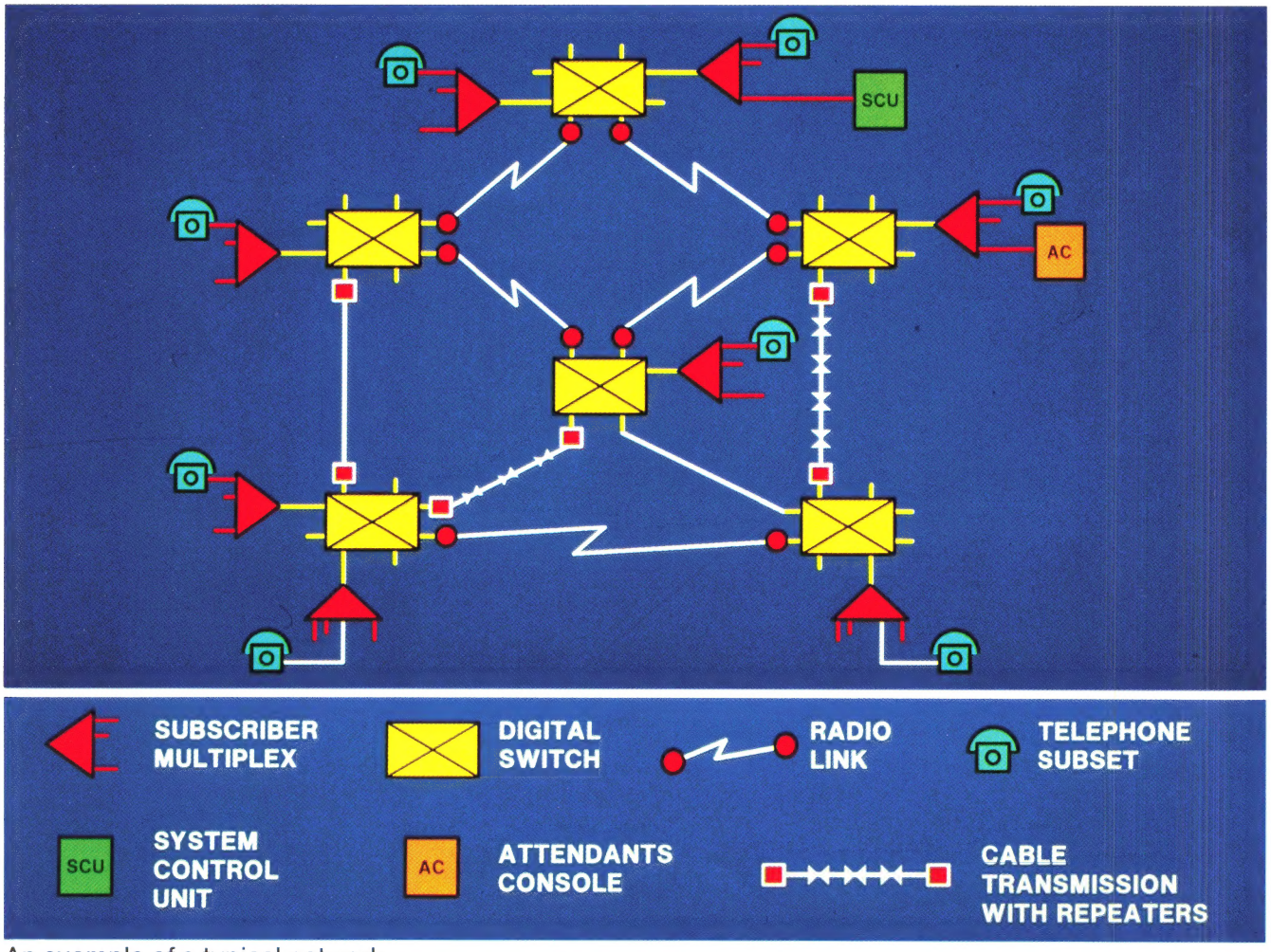
All network components in the STK DEFENCE COMMUNICATION SYSTEM are parts of the same system family. Identical PCB's are used in the SCU, PS and the MS. All components are plug in modules and all connections to the modules are precabled plugs which simplifies installation and service

Expandability

Implementation of new system components or expansion of network with more components is done simply by connecting the new components to the network. The automatic configuration system will register and accept the new components after an authentication procedure has been run.

Mobility

The free numbering system allows all subscribers and the operator console to move anywhere in the network.



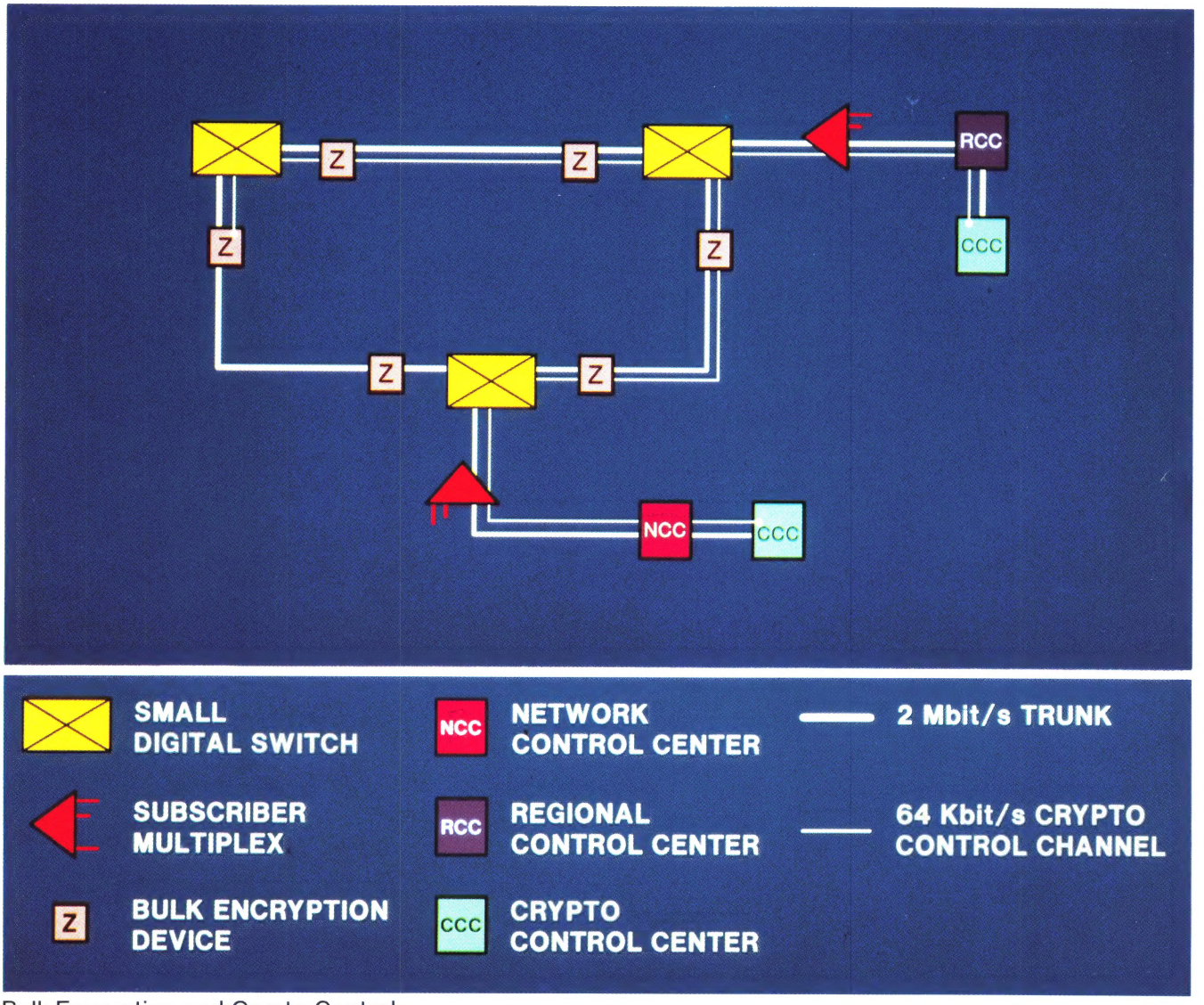
An example of a typical network.

COMMUNICATION SECURITY

The aim of military communication system is to provide flexible, secure, reliable and responsive communication via highly survivable networks. The STK DEFENCE COMMUNICATION SYSTEM provides all these functions in an integrated system. This includes a communication security system.

The system can be equipped with bulk encryption devices on all 2 Mbit/s communication links. Crypto control information, e.g. status information, key distribution and crypto commands are distributed from crypto control centers integrated in the network control centers. Call handling routines and routing algorithms contain functions for processing of traffic with special security requirements. All connections will be set up over secure lines whenever possible. Unclassified traffic can nevertheless be set up over non-secure lines, but in such cases a non-secure warning signal will be given.

Special military requirements concerning environmental characteristics for EMP and EMC are met by using external protection. To prevent radiation, optical fibers are used.



Bulk Encryption and Crypto Control.

RELIABILITY

The fundamental design principles of the STK NODAL SWITCHING SYSTEM are:

- High survivability
  - using adaptive switching network
  - allowing mesh network
  - using distributed synchronization systems
  - using distributed network control systems
  - having redundant capacity for vital traffic.
- Autonomy
  - automatic configuration
  - distributed control
- User service integration
  - integration of telephone and data user services in one reliable network.
- Powerful communications system
  - adaptive spanning-tree routing
  - integrated network control
- International standardization
  - CCITT interface between all network components
  - 30/32 channel PCM concept.

OPERATION & MAINTENANCE

No manual periodic maintenance is necessary for any network components or connections except for a yearly calibration of oscillators.

The Network Control System will detect failures and give alarms. Automatic actions of the network include blocking of units and rerouting of traffic. The units will continously perform selftesting and report the results to the network control system. The control system will in most cases detect failures down to the printed circuit board level.

A powerful set of operator commands for technical, operational and administrative control are available and a carefully designed authorization and authentication system prevents their illegal use.

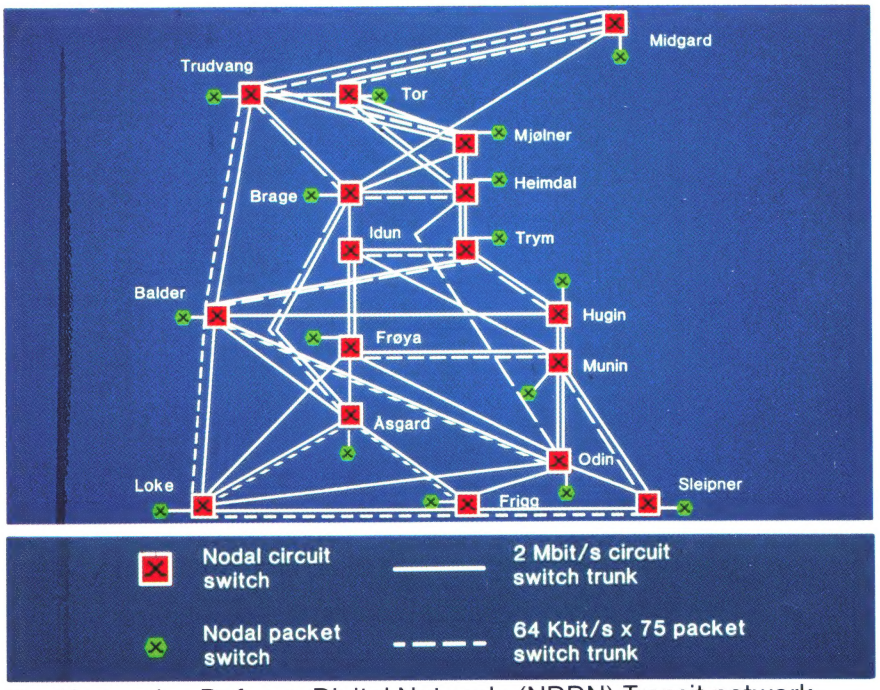
Operation & Maintenance position.

TRANSIT NETWORK

A military communication system typically contains a transit network part providing long distance transmission for various types of regional and local networks or MABX's.

An example of a nationwide military infrastructure network is the Norwegian Defence Digital Network (NDDN).

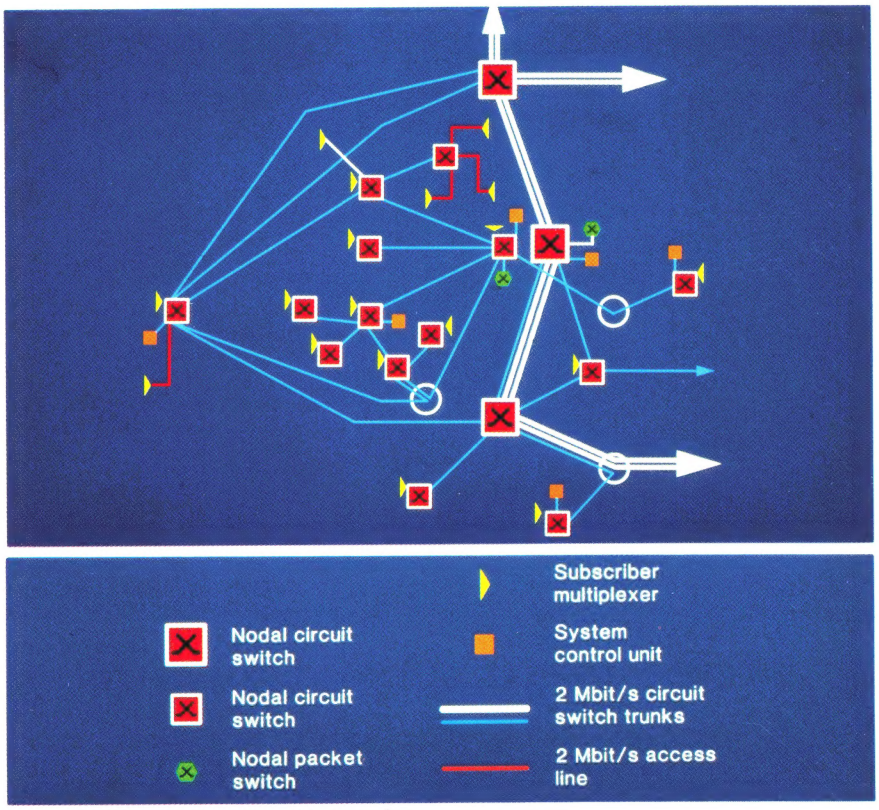
The NDDN transit network contains 17 nodes. These will be interconnected by a meshed network of encrypted 2 Mbit/s transmission links. This network is implemented using the STK DEFENCE COMMUNICATION SYSTEM.



The Norwegian Defence Digital Network (NDDN) Transit network.

MABX's

The STK MILITARY MABX's and the STK MILITARY TRANSIT NETWORK will function together as a single integrated network, as seen by both the end-user and the network operating agency. The equipment modules are the same and this provides significant economic and operational advantages. Since the modules are autonomous and linked by standard interfaces, the units may be geographically separated using standard transmission systems for interconnections. Infrastructure applications cover traditional PABX through distributed PABX network to local and regional networks. The figure snows part of the NDDN, Local Area Network.



The NDDN, Local Area Network.

TECHNICAL DATA

Network Features

- Numbering
  - free numbering
  - hierarchical numbering
- routing
  - saturation routing
  - spanning-tree routing
  - deterministic routing
- Synchronization
  - plesiochronous mode
  - synchronous mode
- Non-secure warning
- Affiliation/Reaffiliation/ Deaffiliation
- Overload and Trunk Access Control
  - 5 load levels
  - 16 trunk access levels
- Selfconfiguration and Autonomy
- Network Control
  - Hierarchical Network Control
  - Communications Security
  - Authentication and authorization
  - Man-machine communication CCITT MML
  - Integrated Crypto Control System

Interfaces

- Analogue Interfaces
  - 2 wire interface to dial pulse or push button telephone
  - 2- or 6-wire interface to local battery
  - 2- or 6-wire interface to public network or external PABX
- Digital Interfaces
  - Asynchronous V-type terminal
    - V.28/V.24, 300–9600 bit/s
    - X.20 bis, 600–9600 bit/s
  - Synchronous V-type terminal
    - X.21 bis, 600–9600 bit/s
  - Digital telephone DT80
    - 4 wire, 80 kb/s
  - X-type terminal
    - X.21, 600–9600 bit/s
    - X.25, 2400–9600 bit/s, 64 kb/s

Subscriber Facilities

- Circuit Switched Services
  - Adress Calling
  - Abbreviated Dialling
  - Covered Indialling, max 8 digits
  - Automatic Answering
  - Hotline (normal and delayed)
  - Sole user connection
  - Multihoming
  - Linegroup
  - Hold and Transfer
  - Redirection Facilities
    - Immediate transfer
    - Don't answer transfer
    - Busy Line transfer
  - Call pick-up
  - Conference facilities
  - Closed user groups
  - Camp on busy
  - Automatic Ringback
  - Priority (4 levels)
  - Precedence
- Packet Switched Services
  - X.25 defined facilities
    - virtual calls (VC)
    - permanent virtual circuits (PVC)
  - Priority (4 levels)
  - Non-secure warning
  - Category-marking of VC

Operating Environment

- Recommended:
- Ambient temperature range 10–35°C
- Relative humidity 15–80%
- Absolute Limit:
- Ambient temperature range 0–45°C
- Relative humidity 10–90%

System Components

Small Digital Switch (SDS)

- Eight 2.048 Mb/s PCM ports
- PCM coding according to CCITT G.711–A law
- 240 non-blocking switching channels
- Time division multiplexing according to CCITT G.723
- Processor system
  - Intel 8086 main processor
  - Max 512 kbyte program memory (PROM)
  - Max 128 kbyte data memory (RAM)
  - Intel 8088 trunk processor
- Signalling
  - loop signalling to multiplexers (abcd-bit in TS 16)
  - common channel trunk signalling
- Software
  - Coding with CHILL
  - Software modules in SDS:
    - signalling
    - call handling
    - manage & maintain
    - on-line test system
    - operating system

- Capacity
  - switching delay $< 240\ \mu s$
  - BER $< 10^{-9}$
  - max 64 conference participants
  - max 4 X.21-registers
  - max 10 general registers (DTMF-reg. or/and Dial Tone Det.)
  - 4 general purpose interfaces (V.24)
  - test interface (V.24)
  - external clock interface (G.703, 75 ohm)
- Power Consumption < 150 W
- Power Supply 48 VDC
- Separate Alarm Panel with 8 digit display and rotary switch
- Dimension
  height 525 mm
  width 532,5 mm
  depth 240 mm
- Reliability
MTBF > 5000 hours
(MIL-HDBK 217 C, 35°C, medium equipped)

Multiplexer

- Max 30 channel units
- Interface to SDS: 2.048 Mb/s, G.732 75 or 120 ohm
- Free configuration of channel units for analogue or digital subscribers
- Power supply 48 VDC
- Power consumption 30–60 W*

  * Depending upon applied channel units and traffic intensity
- Dimension
  Height 370 mm
  Depth 260 mm
  Width 450 mm
- Optional units
  - Timeslot 0 data unit
  - Ringing generator
  - Subscriber measurement unit
  - Terminal regenerator
  - Line power feed unit
- Alarm indication on LED
  - power supply
  - incoming 2.048 Mb/s
  - line alarm
  - channel level
  - remote end

Packet Switch

- Connected through the circuit switch system
- Max 32 subscriber connections (X.25)
  2400–9600 bit/s, 64 kb/s
- Max 8 trunk connections (X.75)
- Processor system
  - Intel iAPX 286 processor
  - Max 3 memory modules ea 512 kbyte
  - Max 5 processor modules
  - Max 3 hard disk drives
  - Max 4 floppy disk drives (5 1/4")
- Standard capacity
  - switching capacity 512 kbit/s
  - call intensity 20 call/s
  - virtual connections simultaneously 1000
  - packet size normally 128 octets
- Dimension
  - Each Packet Switch contains two subracks of
    height 287 mm
    depth 295 mm
    width 514 mm
- Lifetime 20 years
- Reliability
> 5600 hours (380 kbit/s switching capacity)
> 11800 hours (190 kbit/s switching capacity)

System Control Unit (SCU)

- Connected to the system by a X.25-based protocol, 64 kb/s to the multiplexer
- Intel iAPX 286 processor
- Primary memory: max 4 modules RAM of 512 kbyte

Secondary memory
- max 3 hard disk drives
- max 4 floppy disk drives (5 1/4")

- Dimension
  - Each SCU contains two subracks of
    height 287 mm
    depth 295 mm
    width 514 mm
- Test terminal interface: V.10/V.24
- Max 24 serial interfaces (V.11) for connection to multiplexer and I/O-devices.

Digital telephone DT 80

- 80 kbit/s PCM transmission
  - 64 kb/s speech
  - 4kb/s signalling
  - 4 kb/s synchronization
  - 8 kb/s data
- Coding
A-law, AMI-line code
- 4 wire-standard wiring to the multiplexer
- 16 push-button keyboard
- memory of 10 abbreviated numbers
- storing of last dialled number
- 2 line display
- Prepared for connection to DTE
- Dimension
  width 280 mm
  depth 230 mm

Installation

- The equipment is installed in cabinets with
  height 1800 mm
  depth 400 mm
  width 600 mm
- Configuration example in each cabinet
  - 4 MUX
  - 3 SDS
  - 1 PS
  - 1 SCU

Standard Telefon og Kabelfabrik A/S (STK) ranks as one of Norway's most important manufacturers of advanced electronic equipment and communication systems.
During the modern technological era the company has been a leading supplier of switching equipment to the Norwegian telephone network.
In cooperation with institutions such as the Norwegian Telecommunications Administration and the technical branch of the Norwegian Armed Forces, STK has undertaken major research assignments that contribute to its present technological strenght.
This solid base in the Norwegian electronics industry resulted in products such as digital transmission equipment, data modems, containerized telephone exchanges, and cables for communication and power.
Digital communication systems, where STK ranks in the technological fore-front, provide examples of this technical expertise. This product family meets the communication requirements of the future in terms of both speech and data transmission in integrated network.
STK also manufactures all types of cables used in modern telecommunication networks. This product spectrum includes fiber optic cables, a field where the company has invested heavily in development.

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